

of tremendous explosions, like those which truncated Papandayang in Java and shattered Rakata in Krakatoa, or the cone may have collapsed and been engulfed; mother earth, like the fabled Saturn, devouring her own offspring—which has happened on a smaller scale at Kilauea. Mr. Diller, after a discussion of the rival hypotheses, follows Captain Dutton in preferring the latter. Space does not allow of a full discussion of the reasons, but it may be enough to say that the explosive destruction of a great central cone might be expected to have piled up the fragments more or less symmetrically around the margin of the void; but, though much fragmental volcanic material has been scattered over not a few square miles of the surrounding region, this does not exhibit any such arrangement, and its presence may be explained by eruptions posterior to the formation of the caldera, such as that which built up Wizard Island. It must, however, be admitted that such a vast engulfment seems to demand the withdrawal of a corresponding quantity of lava from beneath the cone, and its discharge—as in the Kilauea eruption of 1840—from some distant vent, of which at present no evidence has been found. It is thus possible that each hypothesis is in part correct, for engulfment

tion, owes its present position to being caught up and carried away by the general mass of molten material. This, however, is a very small criticism. The memoir is a most valuable one, and its printing and illustrations maintain the usual high standard of the publications of the United States Geological Survey.

T. G. BONNEY.

#### THE BRUSSELS AND TERVUEREN MUSEUMS.

FOR many years past the Royal Brussels Museum of Natural History has presented attractions for the vertebrate palæontologist which can be rivalled by few and excelled by none of the institutions of a similar nature in Europe. But those who have not had an opportunity of seeing the collections recently will scarcely fail to be surprised at the vast increase which has been made in the exhibited series, and at the excellent manner in which the specimens are displayed even in the limited space at present available. A still greater degree of astonishment, and, we may add, of admiration, will be expressed by the visitor when he is shown the new buildings, now nearing completion, designed for the housing of the entire recent and fossil fauna of the country.

When the present writer (some twelve or fifteen years ago) last saw the collection, only a single skeleton of the far-famed Bernissart iguanodons was mounted in the exhibition galleries. Now there are no less than five such skeletons set up in their natural posture, while a sixth is shown lying on a mass of Wealden rock as it was exhumed from the quarry. A more magnificent display than the one presented by the skeletons of these mighty dinosaurs can scarcely be imagined.

Next in importance to the unrivalled iguanodons and associated reptiles from the Bernissart Wealden may probably be ranked the magnificent series of mosasaurian remains which have been obtained in working the phosphatic beds of the Upper Cretaceous strata of the Maastricht district and other parts

of the country. In addition to several more or less imperfect skulls and other parts of the skeleton of the typical *Mosasaurus*, the collection includes remains of several other generic types, some of which, such as *Hainosaurus*, are peculiar to Belgian territory. Unlike so many European fossil vertebrates of large size, most or all of these generic types are represented by skeletons so nearly perfect as to admit of their being set up like those of recent animals. One of the treasures of the museum is the skeleton of the fore-paddle of a representative of these gigantic marine lizards, this specimen being believed to be the only known example of this part of the mosasaurian skeleton hitherto discovered in Europe. Another noteworthy specimen in this group is the skull of *Prognathosaurus*, remarkable for the exquisite state of preservation of the bones of the elongated muzzle. The turtles of the Upper Cretaceous, as represented by the well-known *Chelone hoffmanni*, and a still more gigantic unnamed species characterised by the extreme flatness of the carapace, likewise form a large and interesting exhibit.

Much more might be written about the Mesozoic vertebrates, but, from exigencies of space; it must

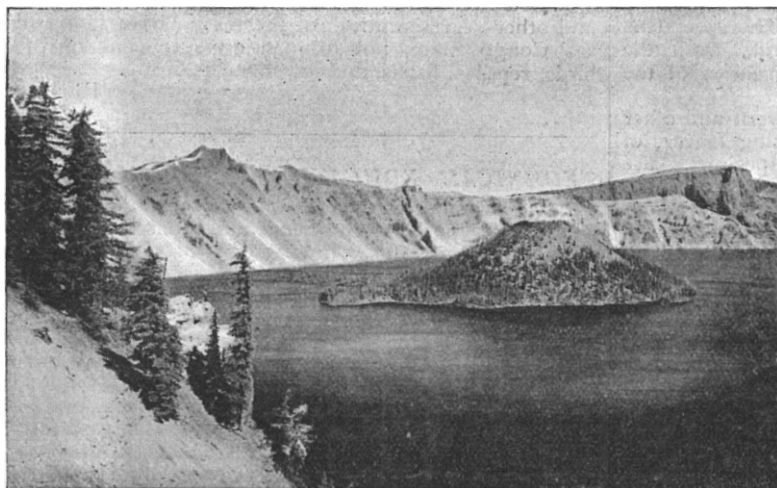


FIG. 1.—Western Border of Crater Lake with Wizard Island.

and explosion may have cooperated in the work of destruction, vast blocks of the ruined cone tumbling inwards to be blown out in shattered fragments and distributed over many miles of country—so that the volcano practically became an automatic muzzle-loader. But that Mount Mazama was not destroyed merely by an explosion like that of a colossal powder magazine, seems to be evident.

In the second part of the memoir Mr. Patton gives us a careful petrographical study of the materials of Mount Mazama. They are mostly, as is so usual with the volcanoes of the great mountain chains of the two Americas, andesites, among which the hypersthene-bearing varieties are common, though on the one hand dacites, and on the other basalts, are to be found. Full descriptions of these and their included minerals are given, as well as of certain portions of a rather different mineral character, which Mr. Patton regards as secretions. It is difficult to form an opinion without an actual study of the rock specimens and slices, but we venture to suggest that they may rather be inclusions—that is to say, material which, though it may have been originally separated by some kind of differential action, and might so far be called a secre-

suffice to refer to an imperfect skeleton of *Plesiosaurus homalospondylus*, and another of *Ichthyosaurus platyodon* from the Lias of Luxembourg. The special interest attaching to these specimens is that, unlike the majority of "halosaurians" from the English Lias, the bones are separate, so as to admit of the skeletons being mounted after the fashion of the Oxfordian plesiosaurs in the British Museum.

Turning to Tertiary fossils, the magnificent series of cetacean remains from the Pliocene of Antwerp is too well known to need more than passing reference. Special attention may, however, be directed to the beautifully preserved skulls of long-nosed dolphins (*Eurhinodelphis*) from the Miocene deposits of the same locality, which have been recently described by Dr. Abel, and are some of the most interesting of all cetacean fossils. Neither is the collection lacking in valuable remains of sirenians, one case containing no less than five more or less imperfect skeletons of a representative of the widely spread Oligocene genus *Halitherium*, while in a second is displayed the skeleton of the body of an allied Miocene type, for which Monsieur Dollo has proposed the name of *Miosiren*. Evidently a large and specialised form descended from *Halitherium*, this genus is characterised by the enormous stoutness and solid structure of the ribs, which are so close together as to simulate a massive carapace in the region of the thorax. The specimens of the rhynchocephalian *Champsosaurus*, from the Lower Eocene, are likewise unique treasures of the collection.

The collection of remains from the cavern and other Pleistocene deposits forms another striking feature of the museum. Among the mounted specimens are three skeletons of the cave-bear, one of the cave-lion, and three of the woolly rhinoceros. The mammoth skeleton from a superficial deposit is one of the finest in existence out of Russia; while of especial interest is the imperfect skull of a very young individual of the same species, with the earlier milk-teeth in position. A skeleton of the much rarer *Elephas antiquus* is likewise noteworthy, first, because the tusks are strongly curved, and, secondly, on account of the peculiar manner in which their tips are worn. This curvature of the tusks suggests that the title of straight-tusked elephant, which has been proposed for this species, is not so diagnostic as it might be. As regards the tips of the tusks, each has been ground into a blunt wedge—a mode of wear never observable in those of either the Indian or African species, and the cause of which is at present inexplicable.

Owing to lack of space, the fossil collections are now mingled with the series of skins and skeletons of recent animals in a manner calculated to confuse the non-scientific visitor, while at the same time the proportions of many of the specimens are not so well displayed as is desirable. All this, however, will soon be remedied, for the magnificent new wing, destined to contain the entire collection of indigenous Belgian animals, is, as already mentioned, fast nearing completion, the whole of the building itself being finished. A notable feature is the entire absence of any architectural decoration in the interior, a feature which might advantageously have been adopted in our own museums. The main hall of this magnificent building is no less than 100 metres in length by 30 in width. The floor is on four different levels, rising in terraces one above the other from the entrance. On the entrance level will be arranged the recent and Quaternary vertebrates (other than fishes); on the first terrace the Tertiary vertebrates, on the second the Upper Cretaceous vertebrate fauna, and on the third and highest the iguanodons and other reptiles of the Wealden. The visitor will thus obtain a *coup-d'oeil*

of the whole effect immediately on entering. The iguanodons will be represented by no less than thirteen skeletons, of which nine are to be mounted and erect, while the remainder are to occupy a large tank-like excavation in the floor, in which they are to lie as in their native quarry. In the gallery running round this hall are to be arranged the recent and fossil fish-fauna of Belgium, while the invertebrates are to be housed on the floor above. By an ingenious arrangement of details, space has been found for a numerous series of large and well-lighted work-rooms. Some idea of the lavish scale on which the new building is planned may be gathered from the fact that the space available for the display of the Belgian fauna alone is four times as great as that allotted in the Paris Museum to the fossil vertebrate fauna of the whole world.

Eventually, I am told, it is hoped that a similar wing may be built on the opposite side of the museum for the exhibition of the fauna and products of the Congo Free State. At present the large collection from that territory (which is the private property of King Leopold) is housed at Tervueren, reached by a tram-ride of about fifty minutes from Brussels. In addition to many interesting anthropological and ethnological objects, the collection contains a fine mounted pair of okapis, as well as numerous antelopes and other representatives of the mammalian fauna of the Congo State, not to mention specimens of the birds, reptiles, fishes, and lower forms of life.

R. L.

#### TECHNICAL EDUCATION AND INDUSTRY.

THE national importance of a close and strong relationship between science and industry is shown by Sir William Ramsay in a letter in Monday's *Times*. Two points upon which emphasis is laid are that numerous scholarships awarded by county councils represent an expenditure of public funds which can do little to promote industrial progress, and that our manufacturers offer few openings for men who have received a sound and scientific education. Technical education, as it is understood in this country, and as most of our technical schools are compelled to understand it if they wish to obtain students, consists of lectures on the rudiments of science, illustrated by practical work of a very elementary kind. It is scarcely necessary to say that the training thus received is of little value to the students or to the community in comparison with the work carried on in the technical high schools of Germany. Sir William Ramsay recently had an opportunity of conversing with the manager of a large chemical works in Germany, which manufactures no product of which it sells less than 100 tons a year, and he directs the attention of our manufacturers to the following facts as to the connection between science and industry in Germany.

The company has seventy chemists, of whom twenty are employed in analysing the raw materials and intermediate and finished products; twenty-five are engaged in superintending the processes of manufacture; and the remaining twenty-five are exclusively employed in scientific work—i.e. in endeavouring to improve the present processes of manufacture, and in trying new suggestions, either their own, or those brought to the notice of the firm by patentees. Almost all these chemists have been trained in universities, but a few come from technical high schools or Polytechnika. It is common for the best of such men to receive a "call" to a chair in a university or a Polytechnikum, and it is also usual for a company to offer a lucrative post to one who already holds a chair, even though he may have had no technical experience, and in this way a close bond has been